

Argonne Leadership Computing Facility makes it easy to be 'green'

From Deep Blue, the computer that defeated Garry Kasparov in a 1997 chess match, to the new Blue Gene® line of high-performance computers created by IBM, a single color has traditionally been associated with advanced computing.

With the recent opening of the Argonne Leadership Computing Facility (ALCF) at the U.S. Department of Energy's Argonne National Laboratory, however, high-performance computing has taken on a different hue: green. Several innovative steps designed to maximize the efficiency of Argonne's new Blue Gene/P high-performance computer have saved many taxpayer dollars while reducing the laboratory's environmental footprint.

While similar computing centers at other laboratories and institutions often require several megawatts of electricity – enough to meet the energy demands a small town – the ALCF needs only a little more than one megawatt of power. Because the ALCF can effectively meet the demands of this world-class computer, the laboratory ends up saving taxpayers more than a million dollars a year, said Paul Messina, director of science at the ALCF.

The Blue Gene/P currently runs at a speed of more than 557 teraflops, which means that it can complete more than 557 trillion calculations



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per second. While several high-performance computing facilities recently established or upgraded at some of Argonne's sister laboratories have surpassed that mark, only one exceeds the efficiency of Argonne's Blue Gene/P. "The Blue Gene/P uses about a third as much electricity as a machine of comparable size built with more conventional parts," Messina said.

Argonne operates the ALCF for the U.S. Department of Energy's Office of Science as part of the larger DOE Leadership Computing Facility strategy. DOE leads the world in providing the most capable civilian high-performance computers for science.

While a megawatt of electricity might seem like a lot of power, the massive number of computations that the Blue Gene/P can do puts it in perspective. Energy efficiency of high-performance computers is measured in flops per watt – how many calculations per second the computer can do for every watt of electricity it uses.

According to the November 2008 Green500 ranking of supercomputers, the Blue Gene/P's energy efficiency averages out to more than 350 million calculations a second per watt. By contrast, a common household light bulb frequently uses between 50 and

100 watts of electricity. Among the top 20 supercomputers in the world, the Blue Gene/P is the second-most energy-efficient. "The fact that we are running such a powerful computer so efficiently shows that we can simultaneously respond to the demands of the advanced simulation and modeling community and the environmental concerns of today's society," Messina said.

Much of the electricity that the Blue Gene/P requires is used not to actually process the computations, but rather to cool the machinery. Without any cooling at all, the room that houses the computer would reach 100 degrees within ten

minutes after the computers started running.

To keep the facility cool and safe, six air handlers move 300,000 cubic feet of air per minute under the floor, keeping the room chilled to 64 degrees Fahrenheit. These air handlers, according to Messina, cool more cost-effectively than large air conditioners used at other facilities. "Many other high-performance computing centers require as much electricity to cool their computers as they do to operate them, but here at Argonne we need only an additional 60 percent," he said. "We not only have a green computer, we have an entire green facility."

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